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NUTR 250: Human Nutrition and Metabolism-A Peer Review of Teaching Project Benchmark Portfolio

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NUTR250: Human Nutrition and Metabolism – A Peer Review of Teaching Project Benchmark Portfolio

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Abstract

The purpose of this portfolio was to purposefully introduce and evaluate activities that are aimed at improving student learning and performance in NUTR250 – Human Metabolism, a large lecture-based 200-level course. Activities were designed to improve class preparation and ascertain student learning beyond exams (objective 1), provide time to review class material (objective 2), balance material related to concepts and knowledge (objective 3), and assess the effectiveness of activities (objective 4). To address objective 1, students completed weekly pre-quizzes, which improved student reading and preparation prior to class in approximately 2 out of 3 students. On average, students spend 33 ± 27 min per week reading and 34 ± 15 min per week completing the pre-quiz. Objective 2 involved the use of a student-response system (iClicker) in class and teaching assistant-led recitation prior to each exam. Students reported that the iClicker helped them understand course material (agreement: 3.9 ± 0.8 on 1-5 scale) and that recitations were a useful addition to the course (agreement: 4.2 ± 0.9 on 1-5 scale) Objective 3 was addressed by labelling lecture content based on key concepts and key knowledge, which improved the performance on selected concept questions (93% vs. 75%) and knowledge questions (53% vs. 41%) during the final exam when compared to the previous semester Greatest predictors of overall class performance were the average exam score ($r=0.95$) and the final exam score ($r=0.84$). Attendance, iClicker performance, and average pre-quiz scores were also significantly correlated with class performance ($r=0.6-0.7$).

Keywords: Large lecture class, recitations, pre-quiz, iClicker

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Objectives of Peer Review Course Portfolio

The objective of the current portfolio is to provide a broad overview of the target course, NUTR250 (Human Nutrition and Metabolism), including existing confinements of the course with regard to curriculum and classroom setting and to purposefully introduce and evaluate activities that are aimed at improving student learning and performance. By creating this portfolio, I seek to conduct a systematic analysis of teaching and assessment style in a large lecture-based course. In particular, I am looking to identify a teaching and assessment style that allows all students to meet the main course objectives while fitting in the constraints of a large class room setting.

The purposeful documentation of teaching efforts and student performance while matching these with my subjective perception of the class will allow me to identify practices strategies that improve my teaching, both on an individual level and with regards to overall student performance. Further, I intend to share the collected data and feedback with department colleagues who teach similar classes and/or wish to adopt similar teaching strategies. While there is currently not a large departmental effort to revise the structure of our curriculum and resource allocation to specific classes, I am hopeful that this portfolio can serve to initiate a department-wide discussion about strategies to modernize the course structure, its place within our department's curriculum, and resources provided for the course.

Course Description

NUTR250 (Human Nutrition and Metabolism) is an introductory nutrition class with a focus on nutrient function and metabolism related to human health. It is a lecture format, large-classroom course with an enrollment of 200+ students per semester. The class provides foundational knowledge in the area of nutrition sciences. For nutrition majors, this knowledge serves as a basis for upper level classes, where many concepts and material will be utilized again and/or advanced. For non-nutrition majors, which include many of pre-professional students, the foundational knowledge acquired during NUTR250 will serve as the primary nutrition background throughout their later professional career.

Course Goals

After completion of the NUTR250, students will i) understand the key principles of human metabolism, ii) have basic knowledge about nutrients (macronutrients, water, minerals, vitamins) and their basic functions in the human body, and iii) understand the role of nutrients in the development of specific diseases

In a broader sense, students need to develop knowledge of key information, which has to be memorized (e.g. nutrient classification, anatomic structures), and an understanding key concepts, which students need to comprehend in order to apply them to a breadth of applications (e.g. homeostasis). By acquiring a strong foundational knowledge, students will be able to evaluate and incorporate additional information from various resources (upper level classes, textbooks, scientific journals, and other online resources), tasks that are needed in almost every profession in a health-related profession. Although the basic course goals are listed in the syllabus, they are not fully integrated into the course structure. Instead, the course is designed mainly around content, and key principles may be explained in the context of a lecture, but there may be overlap with supplemental information. Likewise, key information is presented along with supplemental information without specifically highlighting what is important and what can be derived from other sources and/or core concepts.

Rationale for Choosing this Course

NUTR250 is a core class of our curriculum that has been taught for many years in our department, which makes it difficult to make substantial changes from one year to the next. To my knowledge, there has been a long tradition in our department of using the same textbook, which is also used in upper level classes, and the class has traditionally been very textbook driven. Because of the large enrollment, the class has been taught traditionally in a large lecture-based format (although smaller sections are taught online and over the summer), and assessment of learning has traditionally been conducted via multiple-choice exams. It is unclear whether this lecture-heavy approach is due to the (limited) TA support from the department, or it may be that TA support is limited because previous professors adopted a lecture-heavy style.

After teaching the course for first time in the spring 2017, I noticed that performance varied substantially among students, and that there was a clear pattern differentiating students who

performed well and those who struggled. Generally, students who are self-motivated, interested in the material, appear regularly in class, reply to my questions in class, and are engaged in class activities tend to be well prepared for class and study for all exams. These students usually do very well in the class, and they seem to enjoy a lecture style. However, students who struggle in the class seem to have difficulties with a lecture-heavy style, as evident from complaints in the course evaluations. These students feel that their content is over their head, they do not know what and how to study for exams, and they usually struggle to get a passing grade.

I seek to address these challenges by adopting the following strategies and activities through the Peer Review of Teaching process:

- Clearly identify key concepts, which require understanding, and key information essential for the field of nutrition, which requires memorization
- Improve student engagement with the material within the confinements of a large-classroom setting
- Ascertain student learning beyond exams
- Secure time to review and repeat key concepts and key knowledge throughout semester to allow students to retain key knowledge
- Integrate new approaches while maintaining “department traditions” and keeping requirements consistent within department

The Course and the Broader Curriculum

Most students take NUTR250 at the end of their freshman year or as sophomores. The course serves as core class within the curriculum of our department, and students enrolled in NUTR250 predominantly the following majors: Nutrition Sciences; Nutrition, Exercise and Health Sciences, Dietetics. In addition, about half of the students are on a pre-health track. For most students, NUTR250 is the class where they learn about nutrition, nutrient function, and human metabolism for the first time in a systematic way. For nutrition majors, this class is also serves as an “appetizer”, laying the foundation for more advanced nutrition classes on the 300 and 400 level. However, for many other students (e.g. pre-health, nursing), NUTR250 may be the only time they take a nutrition class.

Because many pre-health students have not declared a major at this time, NUTR250 also serves as a class through which we recruit students into our majors. Depending on the major, students have different goals and objectives for the class. For example, majors in Nutrition Sciences and Nutrition, Exercise and Health Sciences must have a C or better in order to graduate from our program, and as a result some students take the class repeatedly. Students in Pre-Nursing must have a C+ or better. Prerequisites for NUTR250 are quite loose and include 4 credit hours of chemistry or biology and are currently not enforced. As such, the course itself does not require much background knowledge, but many students have an invested interest in the topic area.

Teaching Methods and Course Activities

To achieve the overall objectives of this portfolio, I have integrated several new course activities into the constraints of this large-classroom lecture. Each activity was designed to fit into the current course schedule without compromising current course content. In order to manage the workload of the instructor and the teaching assistant, each activity had to be easily conducted and/or graded through the existing Learning Management System (Canvas) or through similar technology available to each student.

Objective 1: Improve Student Preparation for Class and Ascertain Student Learning beyond Exams

My primary objective was to improve student preparation for class and to ascertain that students learn some material outside of the classroom. Reading and learning outside the classroom is particularly important for this class, as it is typically the first and for non-majors the only nutrition class students take. As such, it provides very basic information. In the past, reading was recommended but not required. As a result, I squeezed as much information as possible into the lecture, which not only made me feel rushed. More importantly, students felt overwhelmed and particularly students who struggled had difficulties filtering important from less important information (see objective 3). By making the reading required (by means of a graded assignment), students will be able to acquire less important information from the reading, which in turn will allow me to focus on key information during class.

To achieve this objectives within the confinements of a large classroom, I elected to provide a pre-quiz for every chapter. These pre-quizzes can be taken online as early as 5 days prior to a new chapter is discussed in lecture. Question on these quizzes are drawn from each book chapter and include both general knowledge questions, which students should be able to complete after reading the chapter once, as well as questions testing very specific knowledge, which requires students to search within the chapter. I chose this blend to force students to actually read each chapter, and not just skim through to find buzzwords. In addition, the last question on each quiz is an open-ended question which allows students to either articulate which aspects of the reading they did not understand or what topics they found most interesting. Students were required to submit their pre-quiz at noon the day before class, allowing me to go through the open-end question when preparing for class.

Objective 2: Provide Class Time for Students to Review Material

My second objective was to provide class time for students to review the material, both during breaks within my lecture and during class time specifically devoted to reviews. To this end, I used a Student Response System, the iClicker, during class and devoted specific lecture times to recitations led by the Teaching Assistant.

The use of the iClicker was designed to provide breaks in my lecture during which students are forced to review the current lecture material. Based on previous experiences with the iClicker, my

goal was to provide a variety of questions, ranging from simple recall to more difficult questions that require thinking and connecting of previous topics, even over multiple lectures. I incentivized student engagement by providing extra credit for correct answers submitted.

The recitations served to review lecture material over the previous chapters and allowed students to assess their state of knowledge. The recitations occurred prior to each exam (total of 4 throughout the semester). Because of the tight schedule, I have not had an opportunity to review class information prior to exams during recitations in the past. To address this challenge, I moved the exam to the Testing Center, allowing students to take the exam outside of class hours. As a result, students gained one full hour of class time per exam, which was used for TA-led recitations.

Objective 3: Balance Course Material between Key Concepts and Knowledge

My third objective was to provide students with more guidance on what course material is highly relevant, and furthermore which of this knowledge falls into concepts, which require understanding, and which material is key information, which requires primarily memorization. Examples for key concepts include basics principles of a metabolic pathway, such as the chemical make-up of substrates and end products (e.g. glycolysis involves the cleavage of a 6-carbon sugar (glucose) into 2 3-carbon molecules (pyruvate) or differences between nutrient categories (e.g. fat-soluble vs. water-soluble vitamins). On the other hand, there is key information students need to memorize, such as the number of ATP molecules produced by a specific metabolic pathway or deficiency symptoms for a vitamin. In the past, I experienced that students were struggling to differentiate between the two and especially weaker students ended up trying to memorizing everything, which overwhelmed many students. As such, my goal was to highlight key information and help students distinguish between concepts and knowledge.

To address this objective, I labeled important lecture material with highly visible symbols that identify key concepts (e.g., a red C in the upper right corner of the slide) and key knowledge (e.g. red K in the upper right corner). These symbols were displayed on slides during lecture (Figure 1) and also appear on the material students can download from CANVAS.

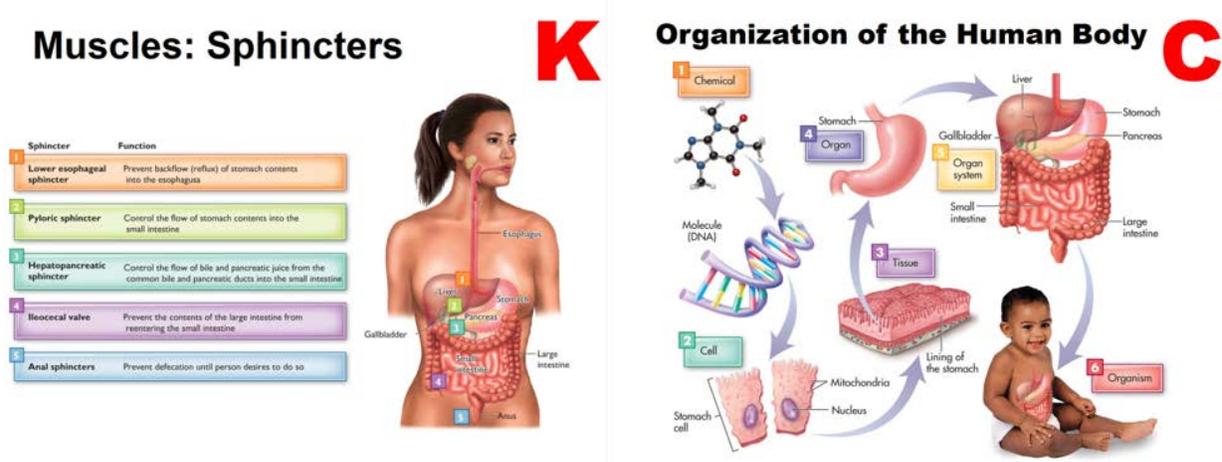


Figure 1 Example of a slide with key knowledge (indicated by the red “K”; left) and a key concept (indicated by the red “C”; right)

Objective 4: Assess Effectiveness of Teaching Activities and Develop Recommendations for the Future

My final objective was to assess the effectiveness and perception of the various teaching activities (reading assignments, iClicker, recitations, labelling of key information) with the long-term goal of improving the effectiveness of how NUTR250 is taught in the future. As NUTR250 serves as core class for our department, it is imperative that the effectiveness of my teaching activities are well documented such that I can fine-tune these approaches and develop best-practice guidelines for other lecturers in the department.

Analysis of Student Learning

Objective 1: Improve Student Preparation for Class and Ascertain Student Learning beyond Exams

When comparing my own experience in the classroom, I noticed a stark improvement in student preparedness from last year, when reading was recommended but not tested. This was particularly noticeable when I asked questions directly related to background knowledge at the beginning of each lecture. In addition, the majority of the students used the open-end question at the end of each pre-quiz to briefly reflect on the content of the reading, which allowed me to get a better feeling for what students did and did not understand from the reason. This alone demonstrates that students were more engaged in the material prior to the lecture.

My perception was in strong agreement with the students' experiences with the pre-quizzes, which were assessed in an end-of-the-semester survey. More than two thirds of the students reported that the pre-quizzes helped them prepare for lectures and that the pre-quiz assignment forced them to read the chapters, suggesting they would not have done the reading otherwise (Figure 2).

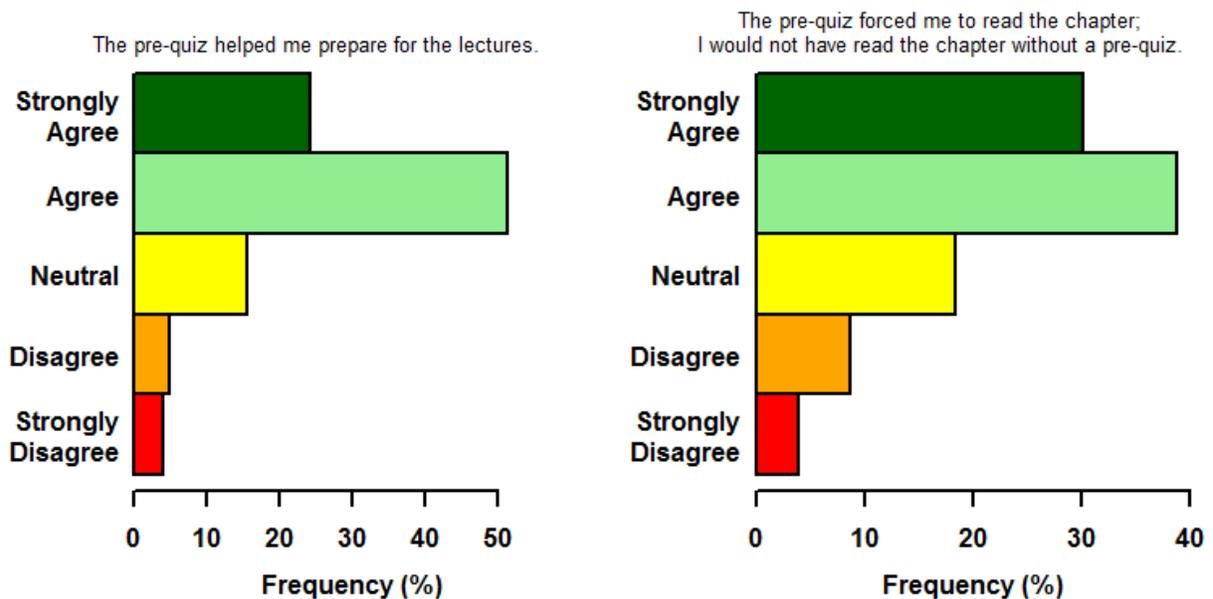


Figure 2. Student responses to specific questions about the pre-quizzes, which were administered after reading the chapter and prior to the lecture.

The majority of the students further reported that reading assignment followed by the pre-quiz provided them with a basic grasp of the material and that the assignment helped them retain and complemented the lecture material (Figure 3). It is further important to note that the assigned reading and pre-quiz helped the students explore the material in more depth, which is an important finding that also addresses objective 3 (balancing key material). Based on the students' response, the assigned reading served to provide non-essential information. In the past I felt I had to address

this non-essential in lecture, resulting in too much lecture material. Another important finding was that the students' perception about the relevance of the reading assignment for the exams neutral on average. This finding is in agreement with the overall purpose of the pre-quizzes, which were meant to engage students with supplemental material not necessarily tested in exams.

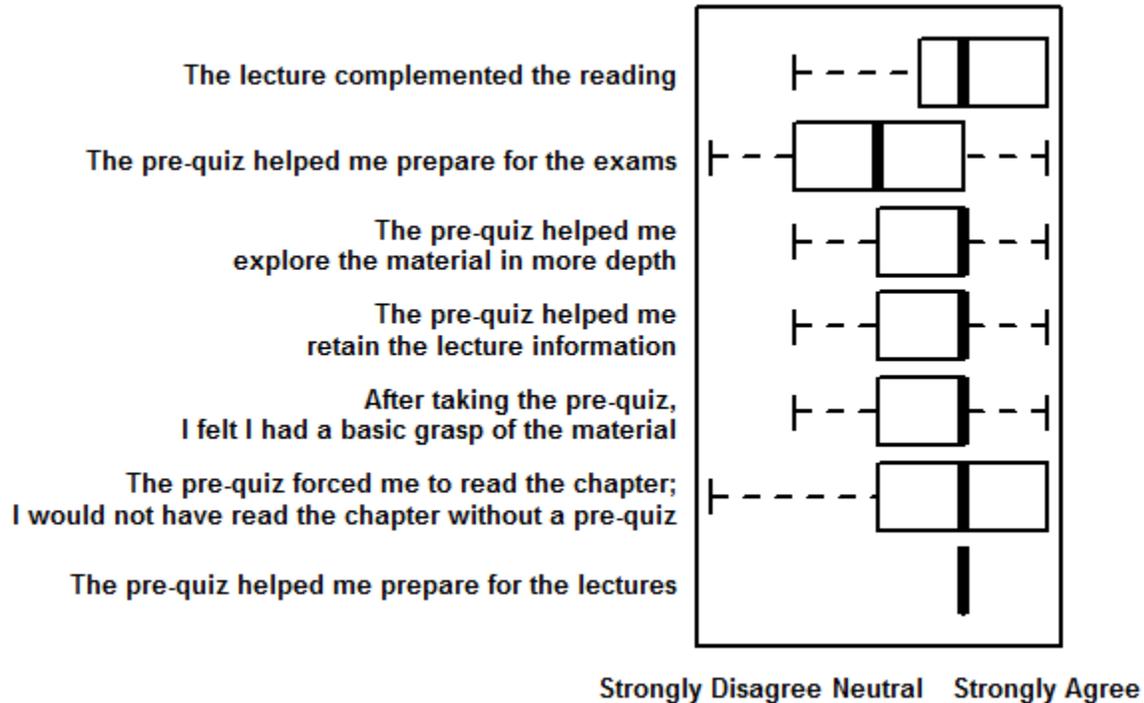


Figure 3. Students' perception of the assigned reading and pre-quiz prior to lecture assessed in the end-of-year survey (n=104).

Students reported to spend on average about half an hour (33 ± 27 min) reading the chapter prior to taking a pre-quiz and a similar time (34 ± 15 min) taking the pre-quiz, resulting in an extra workload of approximately one hour per week. With an average of 2.5 ± 0.6 on a 1-5 scale (1 = "way too hard", 5 = "way too easy"), most students ranked the difficulty of the questions on the pre-quiz as *about right* or *somewhat hard*.

The value of the reading assignment was further highlighted by a student comment:

"I might have taken this quiz prematurely. I have a pretty good understanding [...] so I felt confident in taking the quiz without reading the chapter. I did not however have as much knowledge regarding eating disorders, so I felt like my answers on question 9 specifically were more or less best guesses based on what I would expect. This could have probably been avoided by just reading the chapter first."

It is worth noting that the student scored an 87% on this particular quiz and improved his performance to 95% on the quiz for the next chapter (presumably after reading the chapter).

As shown in (Figure 4), average performance on most quizzes was around or above 90%. However, there were several quizzes with a score that was significantly lower than the final quiz grade (which was calculated as the average of the 12 highest quiz scores). Specifically, the quiz scores were substantially lower for chapters 6 (lipids), chapters 10-13, and chapter 16. There is no apparent reason for the drop in quiz performance for chapter 6. The slightly lower performance for chapters 10-13 might be due to a higher quiz frequency. Whereas most quizzes were taken on a weekly schedule, these chapters were shorter, thereby resulting in 2 quizzes per week at times. Further, the low performance for chapter 16 is most likely the result of a selection bias. As each student was allowed to drop their two lowest quiz scores, many students, particularly those who already had a high quiz score, either did not take this quiz at all or did not read the chapter as thoroughly.

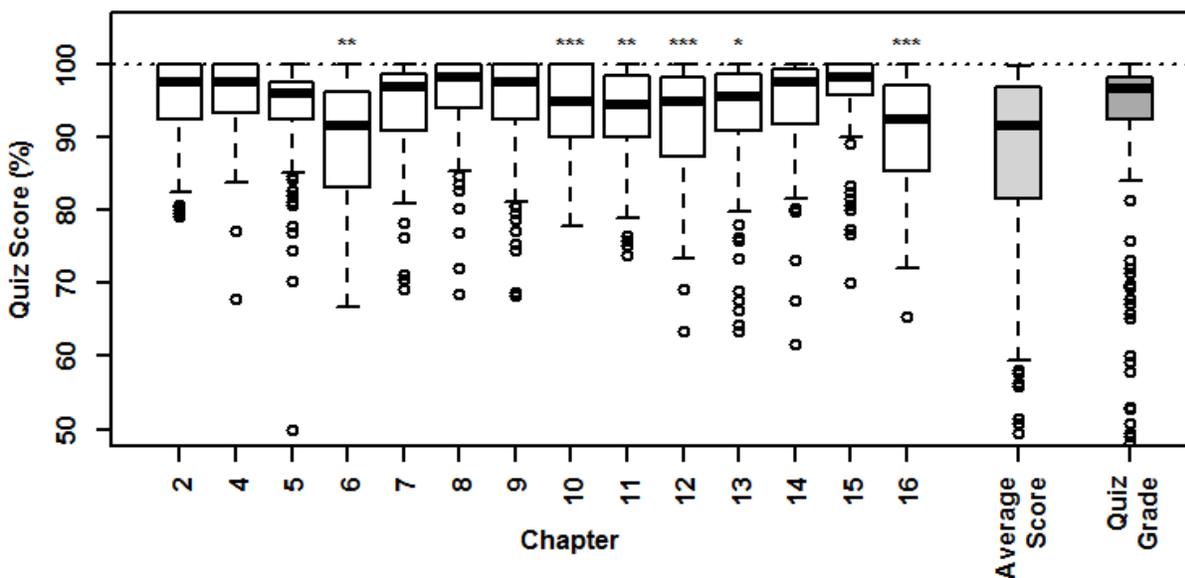


Figure 4. Aggregate data for each chapter quiz (left) as well as the average quiz score (calculated as the average of all 14 quizzes) and the quiz grade (calculated as the average of the 12 highest quiz scores). *, **, ***: significantly lower than the quiz grade ($p < 0.05$, $p < 0.01$, $p < 0.001$)

In order to test the predictive power of performance on the pre-quizzes, students were divided into quartiles based on their average quiz performance. There was a clear linear relationship between quiz score and overall class performance: Students who had a higher quiz score had a significantly higher final grade (Figure 5) and performed significantly better on virtually all class assignments (Table 1).

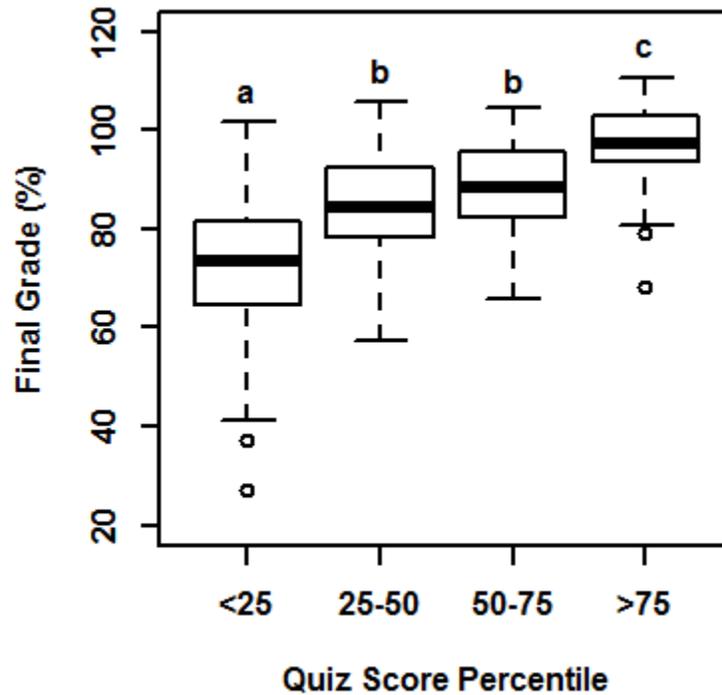


Figure 5. Comparison of final grade relative to the students' performance on the pre-quizzes. Students were ranked into quartiles based on their average quiz scores. Different letters denote significant differences between percentiles.

Table 1. Comparison of class performance relative to the students' performance on the pre-quizzes. Students were ranked into quartiles based on their average quiz scores. Different letters denote significant differences between percentiles.

		Quiz-Score Percentile			
		<25	25-50	50-75	>75
		n=48	n=46	n=48	n=47
Quiz Grade	(10%)	76.5 ± 16.3^a	95.5 ± 2.5^b	96.5 ± 1.4^b	98.9 ± 0.6^b
Average Quiz Score		65.7 ± 14.1 ^a	87.3 ± 3.0 ^b	95.0 ± 1.5 ^c	98.1 ± 0.8 ^d
Exam Grade	(80%)	70.0 ± 14.4^a	77.5 ± 11.5^b	80.9 ± 9.5^b	89.6 ± 8.3^c
Exam 1		74.6 ± 13.0 ^a	80.2 ± 11.0 ^b	80.8 ± 12.8 ^b	87.2 ± 9.8 ^c
Exam 2		61.4 ± 20.2 ^a	73.4 ± 13.8 ^b	72.4 ± 15.2 ^b	87.2 ± 12.2 ^c
Exam 3		70.4 ± 16.6 ^a	76.8 ± 13.4 ^b	80.4 ± 10.8 ^b	89.0 ± 12.0 ^c
Exam 4		63.4 ± 21.4 ^a	73.2 ± 17.6 ^b	78.8 ± 11.2 ^{b,c}	84.2 ± 15.4 ^c
Final Exam		64.4 ± 18.4 ^a	73.0 ± 16.6 ^b	80.2 ± 13.8 ^b	89.2 ± 10.4 ^c
Participation	(10%)	88.3 ± 41.0^a	133.5 ± 33.5^b	137.9 ± 32.4^{b,c}	153.1 ± 28.4^c
Attendance		53.1 ± 24.2 ^a	78.1 ± 19.3 ^b	81.9 ± 17.9 ^b	87.2 ± 14.6 ^b
Final Grade		72.5 ± 14.6^a	84.9 ± 10.2^b	88.1 ± 9.0^b	96.9 ± 8.3^c

Objective 2: Provide Class Time for Students to Review Material

Two class activities were conducted to meet objective 2. First, the iClicker was used as a student response system to allow students to review material during lectures. Second, prior to each exam, the assigned Teaching Assistant conducted a full lecture hour of recitations in preparation for the exam. As shown in Figure 6, the use of the iClicker was very well received by the students. Students felt that iClickers helped them understand the course material and that they retained more information when using the iClicker. Further, students strongly preferred the iClicker over other methods of feedback or challenging questions, such as calling on random students. The majority of the students (71%) reported that the number of questions, which typically ranged between 2 and 5 questions per lecture, was *about right*, although about 21% of the students ranked the number as *somewhat low*. Most students further reported that the time to respond was *about right* (78%) or *somewhat short* (14%).

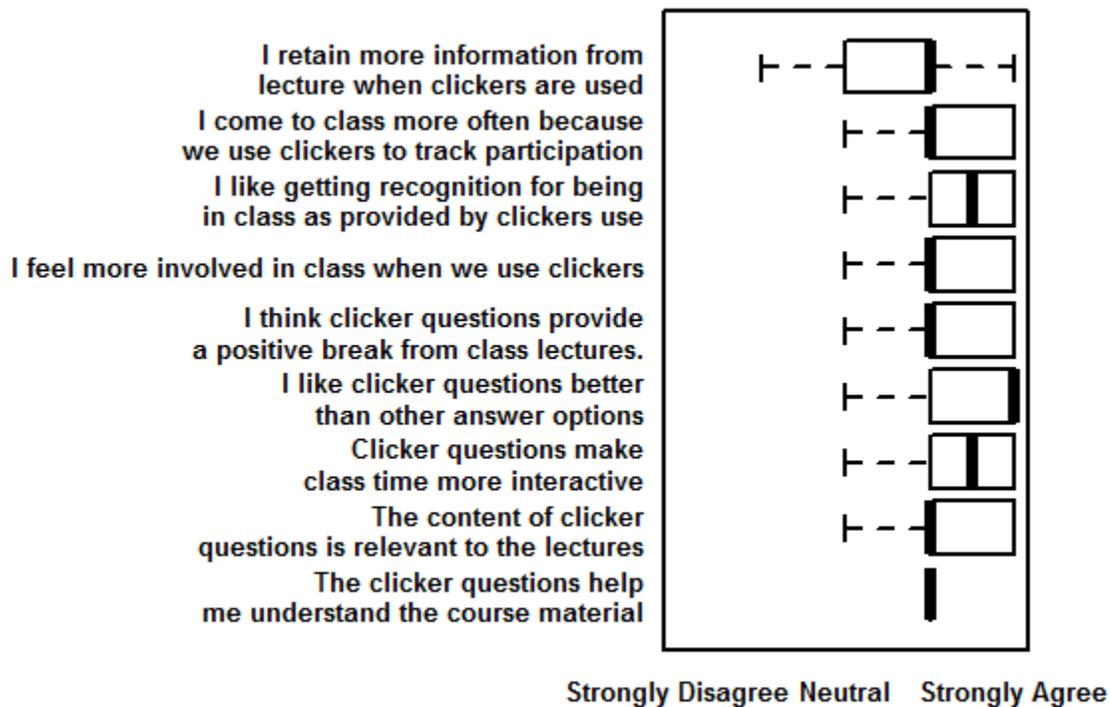


Figure 6 Student perception of the use of iClicker assessed during the end-of-year survey (n=104).

The second activity to provide more class time for review of study material included offering one hour of recitations prior to each exam. All recitations were led by the Graduate Teaching Assistant. Data collected during the end-of-year survey demonstrates that students saw the recitations as very helpful (Figure 7). However, since the recitation sessions were only made possible by moving the exam from the classroom to the Testing Center, the end-of-year survey included a question about the students' preference. Out of all students who completed the end-of-year survey (n=104), the

vast majority of the students preferred having one recitation session prior to each exam while taking the exam at the testing center (79%). Only a minority of the students would have preferred to forego the recitation session and instead take the exam in the auditorium (14%), and a few students felt indifferent about this topic (7%).

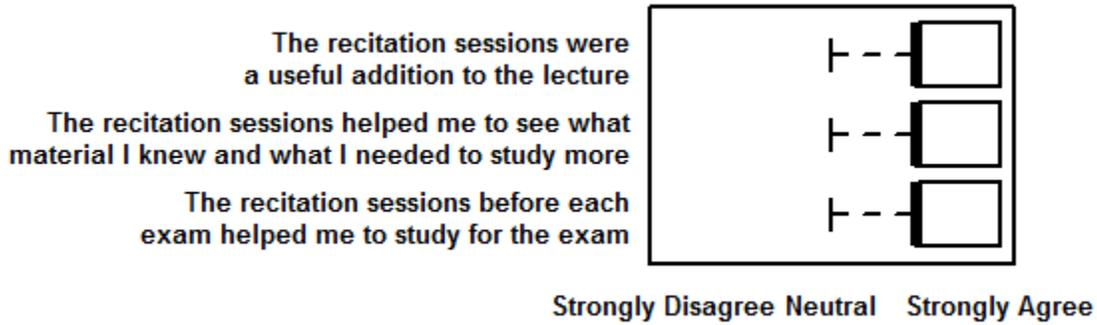


Figure 7 Student perception of the use of recitations assessed during the end-of-year survey (n=104).

Objective 3: Balance Course Material between Key Concepts and Knowledge

In order to allow students to identify key information and to differentiate between key concepts and key knowledge, lecture material was labelled with specific symbols. Data collected during the end-of year survey suggests that the student perception of this this practice was fairly neutral (Figure 8).

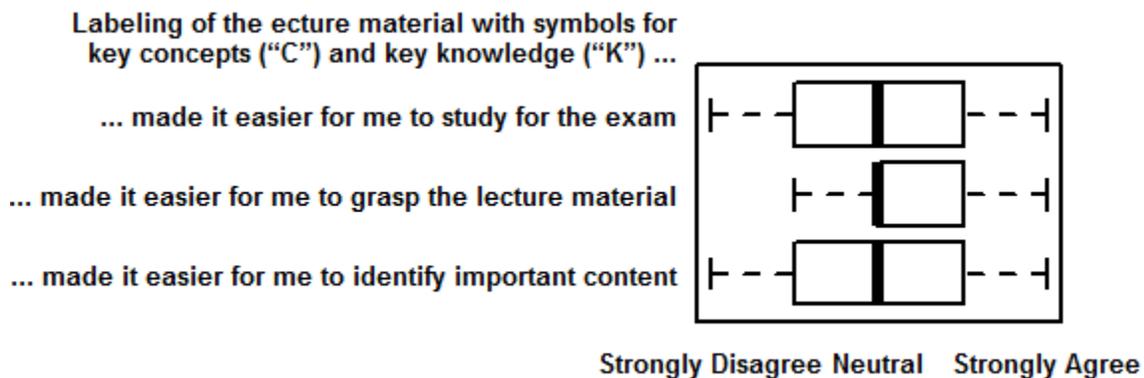


Figure 8 Student perception of the use of recitations assessed during the end-of-year survey (n=104).

Despite this neutral perception, the improvement in exam performance from last year, when slides were unlabeled, to this year suggests that slide labelling may have been effective after all. For example, the performance on two questions specifically targeting key knowledge (“K”) or concepts (“C”) improved dramatically between last year’s and this year’s final exam.

Knowledge question 1:

Backflow from the stomach to the esophagus can result in gastroesophageal reflux disease (GERD) and heartburn. Which of the following anatomical structures functions to prevent this backflow?

This year, 93% of the students gave the correct answer (lower esophageal sphincter); whereas last year, when slides were not labelled, only 75% of students were correct.

Concept question 1:

Which of the following is not a direct effect of insulin?

Again, a higher proportion of students gave the correct answer (increase gluconeogenesis) this year (53%) as opposed to last year (41%), when slides were not labelled.

In addition to comparing between last year and this year, I further sought to determine whether labelling of information would also result in a retention of concepts or knowledge across multiple exams within the same semester. Interestingly, students improved significantly over time on questions related to key concepts, whereas performance on questions related to knowledge did not improve over time..

Concept question 2:

The enzyme _____ is the active form of a protein-digesting enzyme in the stomach that is only active at a _____ caused by the presence of hydrochloric acid.

During the first exam (early February), only 35% and 57% provided correct answers for the two blanks (pepsin; low pH). Correct scores increased to 61% and 71% during the final exam at the end of the semester, highlighting that students developed a better understanding of protein structure and metabolism over the course of the semester.

Knowledge question 2:

Which of the following metabolic pathways/reactions is irreversible and is primarily responsible for why the carbons from fatty acids cannot be used to form glucose?

During the section exam (exam 3), 74% of the students gave the correct answer (transition reaction), and 76% of the students were correct during the final exam. In addition, the performance on this question equally predicted exam scores for exam 3 ($r= 0.54$) and the final exam ($r=0.55$).

These results suggest that key knowledge, which requires mostly memorization, is less likely to improve over time, as additional knowledge is acquired. Regardless, performance did not decline from the section to the final exam, indicating that labeling of information allowed students to quickly (re)learn the material when faced with a larger amount of studying material for the cumulative final exam when compared to the section exam.

Objective 4: Assess Effectiveness of Teaching Activities and Develop Recommendations for the Future

The effectiveness of the different teaching activities was assessed in two different ways. To assess how students used each activity to prepare for their exams, students completed post-exam surveys. In addition, performance on selected course activities was correlated with grade performance.

Post-exam surveys were administered at the end of each exam. Based on the student ratings (Table 2), students utilized each of the four activities at a similar rate. Interestingly, the use of lecture material and iClicker questions declined significantly, albeit minimally, over the course of the semester; whereas, the use of reading assignments/pre-quizzes and recitations remained fairly constant between exam 1 and exam 4.

Table 2: Student rating of contribution of each activity to exam preparation (1=Never, 2=Rarely, 3= Sometimes, 4=Usually, 5=Always)

<i>How much did the following activity help you prepare for the exam?</i>	Exam 1	Exam 2	Exam 3	Exam 4	P-value
Readings Assignments	3.5 ± 0.9	3.4 ± 1.0	3.4 ± 1.0	3.5 ± 1.1	0.44
Lecture material	4.0 ± 0.9	3.8 ± 1.1	3.7 ± 1.0	3.7 ± 1.1	<0.001
Clicker questions	3.6 ± 1.0	3.4 ± 1.0	3.3 ± 1.2	3.3 ± 1.0	0.003
Pre-Exam Recitations	3.7 ± 1.1	3.7 ± 1.2	3.6 ± 1.2	3.9 ± 1.2	0.45

Overall, the highest predictor of overall class performance (Figure 9) was the average exam score ($r=0.95$), which is not surprising, since this accounts for 80% of the grade. Among the exams, the final exam as well as exam 3 were most strongly correlated with the final grade ($r=0.84$). Correlations coefficients for attendance, iClicker extra credit and participation with the final grade ranged between 0.68 and 0.76 and the correlation between pre-quiz score and the final grade was in a similar magnitude ($r=0.63$). Interestingly, participation and attendance scores and pre-quiz performance were only loosely correlated with exam performance ($r=0.3-0.5$).

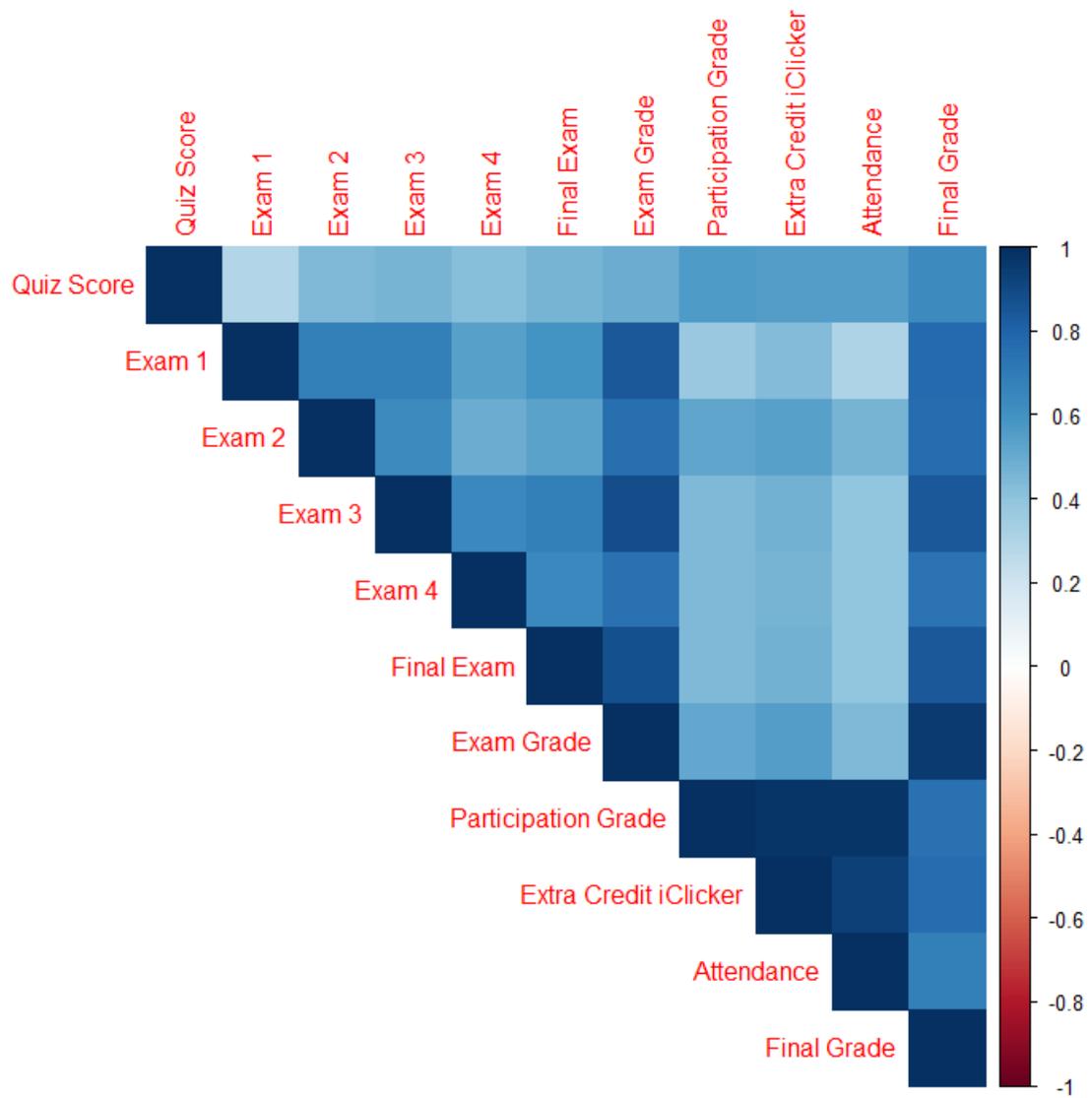


Figure 9 Correlation matrix for class performance and grade information for NUTR250 (Spring 2018).

Planned Changes

Although most of the activities this semester were successful, as demonstrated by improved student performance, positive student feedback and student evaluations, and my own perception inside and outside of the classroom, there is certainly room for improvement. Planned changes for forthcoming semesters of NUTR250, which will build upon the results documented in this portfolio, will target two primary areas: 1) further improving learning outside of the classroom and 2) providing more opportunity for material review.

1) Improving Learning Outside of the Classroom

Based on the data collected over the course of the whole semesters, it is clear that the assignment of pre-quizzes was a very successful strategy, resulting in improved student reading and preparation prior to lecture. While this demonstrably increased student learning outside of the classroom by approximately 90 minutes per week on average, there is currently no equivalent strategy enforcing student learning following lectures. To this end, I am planning to incorporate a post-lecture quiz designed to bridge the time immediately following the lecture and exam preparation. This strategy further aligns with feedback gathered from the post-semester student evaluations, whereby the most-often listed recommendations for future was beginning to study for exams at an earlier time point (data not presented in this portfolio).

By testing specific knowledge and concepts discussed during lecture, the post-quizzes would require the students to spend additional time outside of the classroom reviewing lecture material and their notes. Most likely, a post-quiz would mimic exam questions but would allow students to complete the assignment with their notes and potentially allow students multiple attempts. Similar confinements as those for pre-quizzes will also apply to the development of post-quizzes, such as the ability to automatically administer them through the learning management system.

To account for the increased workload outside of the classroom, I am planning to increase the contribution of pre-quizzes, which currently account for 10% of the final grade, and future post-quizzes.

2) Provide Even More Classroom Time for Recitations

The provision of recitations, even at the current rate of one session per exam, was another strategy that was highly beneficial in terms of contributing to student learning. Based on these findings, I will look into opportunities to provide more frequent recitation sessions. While I consider one recitation session per week to be ideal, this approach would demand adding additional class time, as weekly recitations would not be feasible with the current schedule of two 75-minute lectures. One possible option would be to switch the lecture to a format of two 50-minute lectures (e.g. Monday and Wednesday) and one 50-minute recitation session on the third day (e.g. Friday). Another option would be to schedule several recitations throughout the week to allow students to take recitations more flexibly and for some students to even take recitations repeatedly. This option

would also help reduce the number of students per recitation sessions, thereby allowing for much more direct interaction between the TA leading the recitations and the individual students.

These changes would require both significant alterations to the department curriculum as well as administrative and financial support to provide teaching assistantships, particularly if multiple recitations were offered. As such, these changes will have to be explored together with the department's curriculum committee as well as administrators, including the department chair and Associate Dean for Academic Affairs, and other stakeholders (e.g. Explore Center for Pre-Health students), and would require a considerable lead-in period prior to installation.

Summary and Overall Assessment of Portfolio Process

Overall, I found the process of reflecting and documenting my thoughts for the portfolio process to be extremely valuable. Despite having more than 10 years of teaching experience, I have never used a data-driven approach to assess the effectiveness of particular teaching activities. And while I have tested certain activities in past classes (e.g. iClicker use), these practices were mainly motivated by making attempt to try something new rather than by addressing specific learning outcomes. Using a *Backwards Design* approach was by a very useful tool in helping me identify true course objectives, and I intend to use this approach for the development of new courses.

The structure, designated time and space, and repeated exchange with likeminded faculty throughout the year was extremely valuable for the development of a meaningful portfolio. The Peer Review Teaching Project provided me not only with the tools but also gave me the confidence to test new approaches so that ultimately more students receive a more meaningful education. Although it would be naïve to believe that there is the optimal combination of activities to maximize student learning and motivate students to work hardest, I will continue to challenge myself and my teaching in efforts to become the best teacher possible.

Appendices

Appendix A – Syllabus for NUTR250 (Spring 2018)

COURSE SYLLABUS

NUTR 250 - Human Nutrition and Metabolism (3 Credit Hours)

Spring 2018 – Section 1

Tuesday & Thursday, 9:30 – 10:45 AM, 124 Henzlik

Instructor: Karsten Koehler, Ph.D.
kkoehler3@unl.edu (begin subject line with "NUTR250")
Phone: 402-472-7521
Office Hours: Monday 10 – 11 am or by appointment (104J Leverton Hall, East Campus)

Teaching Assistant: Brianna McKay
bmckay@unl.edu (begin subject line with "NUTR250")
Office Hours: Tuesday 11:00 am – 12:00 pm (Pixel Lab, City Campus)
Thursday 2:00 – 3:00 pm (312 Leverton Hall, East Campus)

Prerequisites: Four credit hours of chemistry or biological science

Textbook: *Wardlaw's Perspectives in Nutrition*, 10th Edition, Byrd-Bredbenner, Moe, Berning, and Kelley. ISBN: 978-0-07-802141-1

Course Description:

The purpose of this course is to provide students the foundational knowledge needed for their studies of nutritional sciences. They will learn about nutrient function in the body, nutrient chemistry and energy metabolism. Also, they will be introduced to the role of nutrients in health and disease and nutrition in the life cycles.

Course Objectives:

Upon completion of this course, students should be able to understand how the following are related to human nutrition and metabolism:

- The science of nutrition and the tools of a healthy diet
- Digestion and absorption
- Nutrients and their classifications
- Metabolism and energy balance
- Vitamins and minerals

Course Approach:

Studying human nutrition and metabolism is a lot like learning a language: although you can get along with a few words, you will eventually need to learn key vocabulary and understand the grammar to become fluent. And as you learn more and more vocabulary and grammar, speaking the language actually becomes fun. In nutrition and metabolism, the grammar are key concepts of metabolism. Once you understand these key concepts, you will find it a lot easier to comprehend the material. And then there is a lot of information which comes with nutrition, which is like your vocabulary. There is certain key knowledge which you simply need to memorize in order to be proficient. And there is supplemental knowledge, which is good to know. But as long as you have heard it and know where to look it up (consider your textbook as your dictionary), you don't need to know it off the top of your head at all times. Lecture material will be labelled with letters C (for key concept) and K (for key knowledge) to help students identify essentials.

While this course is lecture-based, it is important that students come prepared to class by reading the assigned book chapters (see course schedule). It is well established that lecture material is understood and retained much better by students who have been exposed to the material before class. Completion of the reading assignment will be assessed using a pre-class quiz. These pre-class quizzes also allow the lecturer to assess whether certain aspects of the material require more explanation than others. Pre-class quizzes are administered in CANVAS and can be taken up to five (5) days before the beginning of a new chapter. Students are responsible for taking the pre-class quiz on their own.

Grading:

The following grading scale will be used to determine final grades as listed:

97% or more	A+	93-96%	A	90-92%	A-
87-89%	B+	83-86%	B	80-82%	B-
77-79%	C+	73-76%	C	70-72%	C-
67-69%	D+	63-66%	D	60-62%	D-
Less than 60%	F				

The final course grade will be determined based on the percentage of points earned from four exams (20% per exam = 80% total), the class participation grade (10%), and the pre-class quiz grade (10%).

Pre-Class Quizzes:

Pre-class quizzes will be assigned to monitor understanding of assigned readings. There will be one pre-class quiz prior to the beginning of each chapter (total of 14 quizzes). These pre-class-quizzes can be taken in CANVAS up to five (5) days before the beginning of a new chapter and must be completed by 12 p.m. the day before the chapter is scheduled to begin (see course schedule). Each quiz will be comprised of 10 questions worth a total of 10 points. For each incorrect answer, 0.5 points will be deducted, but students cannot lose more than 4 total points if they complete all questions (minimum 6 points for completion). The highest twelve (12) pre-class quiz grades will count towards the pre-class quiz grade; the lowest two (2) pre-class quiz grades will be dropped. The pre-class quiz grade is worth 10% of the total course grade.

Participation:

In-class quizzes will be administered throughout all sessions to monitor understanding of lecture material. Participation in these quizzes will count towards the participation grade. Per session, all students who participate in at least 75% of the questions will receive one (1) participation point. In addition, students may earn additional points by providing correct answers. These additional points will be between 0.1 and 0.5 points per question (depending on the number of questions per session) with a limited of one (1) additional point per session. Additional points can only be used to make up for class absences; additional points cannot be used as extra credit for exams or pre-class quizzes. The participation grade will count for 10% of the course grade.

Student Response System (i>Clicker):

We will use i>Clicker as student response system. i>Clicker is a response system that allows students to respond to questions posed during class, and students will be graded on that feedback and their in-class participation. Students are required to bring their i>Clicker to every class. It is each student's responsibility to come prepared to participate with a functioning i>clicker everyday. I>Clicker devices can be purchased or rented through the University bookstore. i>Clicker devices must be registered in Canvas at the beginning of the semester so that each student's device is directly linked to their Canvas account. For troubleshooting with i>Clicker, please refer to instructions made available by ITS (<http://its.unl.edu/srs>) or on Canvas. If students have lost or broken their i>Clicker remote, they will have to purchase or rent another one. Please inform the TA or instructor. Bringing a another student's i>clicker to class is considered cheating. If a student is caught with an i>Clicker other than their own or has votes in a class that they did not attend, they will forfeit all participation points and may face additional disciplinary action.

Exams:

Five (5) exams will be given throughout the semester. The first four exams will cover each preceding section (see course schedule). Only the final exam will be comprehensive. The exam score will be calculated as the average of the highest three section exams scores and the final exam score. The lowest of the four section exam scores will be dropped. The exam score will count for 80% of the course grade.

Exams for this course will be taken under electronic supervision at the **Digital Learning Center**. For each exam for this course, exams can be taken during five (5) days (see course schedule). All students are responsible for self sign-up and early sign-up is recommended as time slots fill up quickly. Students can start signing up for test times up to two weeks before the first day of a scheduled exam.

Because the exam can be taken over multiple days, there are no make-up exams. In addition, if one section exam is missed, it can be made up with the final exam. It is only possible to drop one exam with your final exam grade. If the final exam is missed, the final exam score will be 0, and will count for 25% of the exam grade.

The Digital Learning Center is located in the Adele Coryell Hall Learning Commons. All testing times are pre-scheduled and exams will be completed on a computer. Before you begin an exam, you must place your personal items in your pre-assigned locker and check-in with Digital Learning Center staff at the front desk. When you have completed your exam, you must check-out at the front desk.

- All students are required to have their current N-Card to test. Other forms of ID will not be accepted as a substitute for N-Cards. DLC staff reserve the right to ask for a second ID if needed for identity verification.
- All students will receive two pieces of barcoded scratch paper for their exam. This paper will be scanned in to students upon check-in and scanned out upon check-out.
- Only permitted items are allowed at your computer station during testing, including your N-Card, DLC provided barcoded scratch paper, and writing utensils. Nothing else is allowed at your computer station unless your instructor has made prior arrangements with the DLC.
- All exams must be submitted for grading at the posted closing time. Students will not be given additional time to finish their exams past the posted closing time.

To schedule your exam, please visit <http://dlc-reserve.unl.edu>. For more information about the Exam Commons location, operating hours and student guidelines, please visit <http://dlc.unl.edu>.

Progress:

It is highly recommended that students monitor their grades online throughout the semester. The teaching assistant or instructor will be available by appointment to meet with students individually to discuss their grade.

Learning Management System:

The Learning Management System for this course will be Canvas (<https://canvas.unl.edu>). Class material and graded will posted online. It is the responsibility of each student to access Canvas regularly and to configure their notification settings so that they will be notified of assignments, announcements, and course changes.

Classroom Conduct and Student Responsibility:

- The instructor is committed to offering a course that maintains an atmosphere of ethical behavior, individual integrity, and equitable treatment of each person. Expression of ideas from various perspectives is encouraged and acknowledges the dignity of all class members.
- Students are responsible for attending all classes, arriving on time to class, participating in class discussions, taking notes, and obtaining other materials provided by the instructor, taking exams and quizzes, and completing assignments as scheduled by the instructor.
- The course syllabus and schedule may be changed at discretion of the instructor. Changes will be announced in class and a revised syllabus/schedule will be posted on Canvas. Students are responsible for keeping track of changes in the syllabus and schedule throughout the semester.
- Behaviors that disrupt other students' learning are not acceptable (e.g., arriving consistently late for class; cell phone use, reading non-course related materials, social conversation during class), and will be addressed by the instructor. All students will show respect toward all others, and act in a courteous manner.
- The use of cell phones, laptops, tablets, or other electronic devices is prohibited during class, unless explicitly allowed by the instructor. Cell phones must be silent and on airplane mode during class. Likewise, all devices capable of making a sound must be silent before entering the lecture hall.

Attendance:

- Students are expected to attend all classes to receive announcements and lecture material. If a student is absent from class, it is their responsibility to obtain the class content from other students who were present. Only students who attend class are eligible for participation points.

- Students must contact the teaching assistant or instructor as soon as possible if they anticipate missing multiple classes due to events such as chronic illnesses, travel related to team sports, or other University-sanctioned activities.

Statement of Academic Integrity:

Academic honesty is essential to the existence and integrity of an academic institution. The responsibility for maintaining that integrity is shared by all members of the academic community. To further serve this end, the University supports a Student Code of Conduct which addresses the issue of academic dishonesty. The Student Code of Conduct can be found on Student Affairs website at <http://stuafs.unl.edu/ja/code/three.shtml>.

Diversity Statement:

The University of Nebraska-Lincoln is committed to a pluralistic campus community through Affirmative Action and Equal Opportunity. We assure reasonable accommodation under the Americans with Disabilities Act. Students with disabilities are encouraged to contact me for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, student must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.

Syllabus changes:

Please note that this syllabus and the schedule are subject to change. All changes will be announced during class and revised versions of the syllabus and schedule will be uploaded on Canvas.

Course Schedule

This is a tentative schedule that is subject to change by the instructor.

Week	Day	Date	Lecture	Topic	Reading
1	Tue	1-9	1	Course Introduction	
	Thu	1-11	2	The Science of Nutrition	Chapter 1
2	Tue	1-16	3	Tools of a Healthy Diet	Chapter 2
	Thu	1-18	4		
3	Tue	1-23	5	Human Digestion and Absorption	Chapter 4
	Thu	1-25	6		
4	Tue	1-30	RECITATION Exam 1 (Lectures 1-6)		
			Exam 1 (Testing Center; Wed 1-31 to Sun 2-4)		
	Thu	2-1	7	Carbohydrates	Chapter 5
5	Tue	2-6	8	Lipids	Chapter 6
	Thu	2-8	9		
6	Tue	2-13	10	Proteins	Chapter 7
	Thu	2-15	11		
7	Tue	2-20	12	Alcohol	Chapter 8
	Thu	2-22	13		
8	Tue	2-27	RECITATION Exam 2 (Lectures 7-13)		
			Exam 2 (Testing Center; Wed 2-28 to Sun 3-4)		
	Thu	3-1	14	Energy Metabolism	Chapter 9
Tue	3-6	15			
9	Thu	3-8	16	Energy Balance and Weight Control	Chapter 10
	Tue	3-13	17		
10	Thu	3-15	18	Spring break	
	Tue	3-20			
11	Thu	3-22		Nutrition, Exercise, and Sports	Chapter 11
	Tue	3-27	19		
12	Thu	3-29	RECITATION Exam 3 (Lectures 14-19)		
			Exam 3 (Testing Center; Fri 3-30 to Tue 4-3)		
13	Tue	4-3	20	Fat Soluble Vitamins	Chapter 12
	Thu	4-5	21	Water-Soluble Vitamins	Chapter 13
14	Tue	4-10	22	Water and Major Minerals	Chapter 14
	Thu	4-12	23		
15	Tue	4-17	24	Trace Minerals	Chapter 15
	Thu	4-19	RECITATION EXAM 4 (Lectures 20 – 24)		
			Exam 4 (Testing Center; Thu 4-19 to Tue 4-24; Testing Center closed Sat 4-21)		
16	Tue	4-24	25	Nutrition Across the Life Stages	Chapters 16-18
	Thu	4-26	26		
Final			FINAL EXAM (Testing Center; Sun 4-29 to Thu 5-3)		